PLAY, GAMES, AND ATTITUDE: STUDENT AND TEACHER PERSPECTIVES OF EDUCATIONAL GAMES

By

GERRI MONGILLO*

* Assistant Professor, William Paterson University, New Jersey.

ABSTRACT

The main purpose of this qualitative study was to determine the influence of participation in educational games on cognition and attitudes of seventh-grade students. Student attitude towards learning scientific language and concepts during gameplay was examined. This study was conducted in a seventh-grade science classroom in a North Eastern (USA) middle school. The effects of collaboration, socialization, membership, identity, and game culture were examined. Findings indicated that the use of educational games engaged various types of learners via an Alternate Learning Approach. Specifically the students who have limited language skills may benefit from games through the use of common language. Also students who are disinterested or reluctant to talk in class may be encouraged to voice their opinions and ideas in the more relaxed group setting provided by game structures that foster cooperative learning.

Key words: Middle School Education, Educational Games, Attitudinal Development.

INTRODUCTION

Primary grade teachers have long understood the benefits of using games as a method to re-contextualize learning. In our work driven middle and secondary classrooms, play is eliminated from the curriculum in favor of direct instruction in what is referred to as the antiplay philosophy (Johnson, Christie, &Yawkey, 1999). If play appears at all in later schooling, it is relegated to the non-essential status of an extra-curricula activity, or used as a reward system (Framberg, 2002). Games are demoted to an inferior status in middle school curricula because of the pejorative perspective of play and often regarded tangential; many educators perceive games as meaningless child's play. This perspective of games suggests that the benefits of play in the development of student's cognitive and attitudinal capacities are overlooked and under rated in traditional middle school instruction (Holton, Ahmed, Williams, & Hill, 2001).

Games for the purpose of this study were defined as having at least two or more players, an element of challenge and competition following a predetermined set of rules, and criteria for winning (Jacob & Dempsey, 1993; King, 1986). Not all games are educational, interesting or motivating so the question arises concerning the selection and implementation of games that address cognitive and attitudinal development.

Review of Related Literature

Extensive research validating the use of play, including the play of educational games, has been done on the primary level (e.g., Bruner, 1983; Bruner, Jolly, & Sylva, 1976; Framberg, 2002; Kamii, 1985, 1989) suggesting that there is a strong relationship between gameplay and the development of cognitive and attitudinal competencies (e.g., Bredekamp & Copple, 1997; Bruner, Jolly, Sylva, 1976; Johnson, Christie, & Yawkey, 1999; Kamii & Lewis, 1992). However, there is less research on the value of play and games with upper elementary or middle school age students.

An attribute of play not to be overlooked is the contribution play makes toward enhancing the older student's attitude towards learning. One of the essential components of attitude was described as "a preparation or readiness for response" (Allport, 1935, p. 805). That is, an individual's reaction to a situation is determined by past experiences, either positively or negatively. These prior experiences affect both interest and motivation.

Educators frequently bemoan the middle school

student's lack of interest and motivation as an obstacle to learning. Many middle school students' attitudes taward learning are negatively affected by the irrelevant manner in which academic material is introduced (Alberts, 2003). Students find little or no connection between learning and their everyday lives. In additian, schaal-based learning and play become mutually exclusive concepts. Dewey (1916) aptly commented on this disconnect when he stated that "the passage from play to work should be gradual, nat invalving a radical change af attitude but carrying into work the elements of play" (p. 10). This suggests that the cognitive and attitudinal capacities develaped thraugh play may transfer ta life lang learning strategies.

Althaugh games and play are nat apparent in adolescent schooling, they are an integral part of their daily lifestyle. One has only to observe the out-of-school activities af these students ta see the amaunt af time and effort they spend on various games that require multiple literacy skills (Alverman, Hinchman, Moore, & Phelps, 1998; Bean, Bean, & Bean, 1999; Gee, 2003; Maje et al., 2004). Inclusive in the concept of multiple literacies are the various ways of communicating described as accepted language use in specific social and situational cantexts (Gee, 1996; Street, 1995) as well as a variety af new multimedia technologies (New London Group, 1996/2000).

Student attitude toward learning may not only be addressed by participation in games, it may be aptimized. Psychalagist Csikszentmihalyi (1991) theorized that we achieve optimal experiences through a trancelike state he called flow, a condition that is often achieved in play. Accarding ta Csikszentmihalyi we are tatally absarbed in all aspects af play during the flaw state, the experience is one "that focuses attention and motivates actian" (p. 32).

Finally, the implications from the research on cooperative games (DeVries & Slavin, 1976) include mare effective teaching and learning, impraved student achievement, and improved attitude toward learning.

Purpose of the Study

This qualitative study sought to discover the impact on student attitude towards science learning where games were implemented as an educatianal strategy. This study was conducted within a seventh-grade classroom consisting of 27 average ability students aged 12-14 in arder ta abserve and describe gameplay as it naturally accurred. Data was callected fram six participants (2 female, and 4 male) from one class section. The curriculum in this classroom was chiefly designed around majar scientific tapics that were implemented within an inquiry-based model of instruction. Findings discussed are taken from a larger study that also examined language and cancept use during games, hawever this paper will facus specifically an the fallawing research question: What affect does participation in educational games have on student attitude toward learning scientific language and cancepts?

Method

Data Sources

Over the course of this study, data were collected through teacher and student interviews, classraam abservatians, self-study evaluatians and field nates. Data callectian commenced at the start of the Earth History unit. The length of this study was 6 weeks. This researcher observed, interviewed, and recarded classraam activity at least 3 days each week. The classroom teacher implemented 5 educational games during the unit of study. The types of games abserved varied and included versians af papular game shaws (i.e., Gameshow, Jeopardy®, Memory, and Pyramid). Frequently the teacher created the game questians but in at least ane instance (Gameshaw) the students created the questians and answers. Students integrated technologies to create games such as using the Internet to research question and answers; and they alsa used an electranic versian af Jeapardy® which was lacated an the Internet. Using this electranic versian the teacher was able to insert content specific questions and answers and the students were able ta play the game, in teams using the classraam camputer. Educatianal games implemented in the classroom were audio taped

while the researcher recorded field notes. One element of study during games facused an the participants' behaviars and attitude. The purpase af audia taping gameplay was to holistically understand the dynamics of the game and capture the interactions between all of the participants during the games.

The participants' audia taped interviews were analyzed ta discaver their attitude taward learning science thraugh educational games. Responses to each interview question were analyzed separately to understand patterns that led ta understanding af the participants' perspective and attitude concerning games. Field notes were analyzed and data was used to compare tentative results from the interview findings. In additian ta the initial interviews, impramptu interviews accurred with bath the teacher and the students during the study and near the end of the study. These interviews were also tape recarded, and the researcher wrate field nates.

Data Analysis

First, the teacher and student audio taped initial interviews were transcribed and analyzed ta discaver the participants' beliefs concerning educational games. Frequency of recurring themes were noted, compared and cantrasted ta create discrete categaries as the data was systematically coded. Next, the subsequent interviews with the participants were transcribed and coded comparing the patterns from the initial interviews ta the later.

One af the student dacuments callected and analyzed was the teacher created and administered Study Strategy Evaluation Form. This self-evaluation form pravided impartant insights ta haw students perceive the value af games and their role as participants in games.

Qualitative pracedures were used ta callect and analyze data. Qualitative data were analyzed thraugh a lagica-inductive process where topics were identified, clustered in categories, and patterns were formed fram these categaries. Finally, explanatians and interpretatians were formed, based on the categories and used to answer the research questions (Mertler & Charles, 2008). The pracess was based an lagic ta make sense af the narrative and verbal data. Analysis was ongoing and it was thraugh this constant camparison methad that the researcher faund emerging trends and patterns in the data (Hubbard & Power, 1999). Reliability was assured through this process as well as triangulation of data saurces. Cansistent with the design af the qualitative study, findings were reparted through a rich, thick description of the phenomena which creates for the reader the sense of having been there (Guba & Lincoln, 1981).

Results and Discussion

Attitudinal Development Toward Science Through Educational Games

Attitude was defined in this study as the mental pracesses that determine the responses of each person in the social world (Allport, 1935). Further, attitudes are formed based an aur values and beliefs mediated by our cultural backgraund and daily sacial interactian. The analysis af participant interviews, self-evaluation forms, and gameplay observations provided information relating to the research questian cancerning the affects af educational games on student attitude toward learning scientific vocabulary and concepts.

Student Interview Analysis

Data analysis of the initial interviews suggested patterns in the following three categories: Motivation, Interest, *and* Fun. Table 1 pravides definitians af these categaries and samples of student (all names are pseudonyms) responses from the initial interviews that exemplify these categaries. The definitions far these categaries were graunded in the thearetical ratianale set farth in this study as well as a reflection of the participants' responses.

Category	Definition	Examples from the Initial Interview
Motivotion	Motivotion is the reoson we act and guides our interest and attitudes.	Student view: Like, when I know we ore going to play a gome I like to come to class."
Interest	The quality of exciting curiosity or holding one's ottention.	"Student view: Games make it [science] more interesting.."
Fun	To enjoy an octivity, omusement.	Student 1 view: "Gomes are o fun woy to leorn. Student 2 view: Gomes ore pretty fun."

Table 1. Students' Initial Perspectives of the Affect of Educational Games on their Attitude

Motivation, Interest, and Fun

Motivation was defined as the reason for why we act and motivation guides our interest and attitudes (Hallowell, 1955). Only one student (1 of 6) said thot he enjoyed science as a subject. Participants reported thot educational games increased their motivation to participate in o clossroom octivity when the games were based on scientific vocobulary and concepts. Porticipants suggested that they looked forward to coming to class when they anticipated gameplay and onother student explained, "Games ore a better way to study vocobulary and concepts than just reading...it [games] makes it easier and fun [*sic*] than tests."

Interest was defined as the quolity of exciting curiosity or holding one's attention. Interest is closely reloted to motivation in that when students are motivated by an octivity, their interest is increosed. Participonts reported during the interview that the games increased their interest in science. Gomes peaked curiosity for some and os one student stated games "make it [the study of science] more interesting." Another student spoke of the excitement of games because of the possibility of winning, "I like competing even though we don't olways keep score . . . you know, it gets you into it."

Responses where the participants discussed playing games as an enjoyment or amusement were categorized as Fun. All (6 of 6) described games as "a fun woy of learning!" One student elaborated referring to the games played in previous science units "I found playing the games helpful because you were having fun and leorning at the same time." From the students' perspective, the games mode learning science enjoyable, although the majority (5 of 6) said that they did not like science as a subject.

Overall, the findings for the initial interview suggested that students' perceived the affect of educotionol games on their attitude toward leorning scientific vocobulory ond concepts as positive. The notable benefits of gameplay identified included, motivation to participate, increosed interest in porticipating in on activity using scientific longuoge and concepts, and experiencing an enjoyable activity (Fun).

The findings of the finol student interview (Toble 2) were analyzed and compared to the initial interview. Although the conversotion was guided by the questions asked in the initial interview, new issues were discussed. The analysis yielded two additional patterns in the final interview doto, namely (i) Relief from Boredom and (ii) Alternate Leorning Approach. These additional categories may have been generated because the final interview was conducted in a whole group talk where students had the opportunity to elaborate ond extend their responses precipitated through feedbock from their peers.

The category *Relief from Boredom* is ossociated with the porticipants' ottitude toward an activity. During the final interview the participants mentioned that the Earth History unit contained a greot deal of reading which they considered dull. That is, they found both the scientific content and the activity boring. The teacher also mentioned in her interview that this unit was content heavy and "contoins too much vocabulary and concepts." This unit contained less honds-on activities than other units they had studied during the year. The students olso discussed that playing games relieved their boredom. One student explained, "Studying straight from a book you kindo [*sic*] get bored after awhile and it's hord

Cotegory	Definition	Exomples from the Interviews
Motivotion	Motivotion is the reoson we oct ond guides our interest ond attitudes.	Student view: "I don't like science ...when we play gomes I look forword to coming to class."
Interest	The quality of exciting curiosity or holding one's attention.	Student view: "I feel excited ond curious because we play gomes."
Relief from Boredom	In ploy we ore obsorbed by the octivity ond our attention is focused on the oct of constructing knowledge.	Student view: "Yeoh, when ploying o gome, I'm olways into it, owoke ond stuff. "
Fun	To enjoy on octivity, amusement.	Student view: "Gomes ore o fun way to learn."
Alternote Leorning Approach	A non-troditionol or o non-didoctic leorning approach or strategy.	Student view: "I know when I play o gome I remember more."

Table 2. Student Perspectives of the Affect of Educational Games on their Attitude Over Time

to focus sometimes."

During the play of educational games the participants had the opportunity to become focused on the science content because they were not bored by the activity. Related to the Relief from Boredom category is the concept of flow, (Csikszentmihalyi, 1997) a condition where one is totally absorbed in an activity. The flow state creates an optimal learning condition because there is intense focus on using skills to construct knowledge. According to Csikszentmihalyi (1991) play provides the conditions necessary to achieve the flow state because in play, we are focused and interested.

An *Alternate Learning Approach* was defined as a non-traditional or a non-didactic learning approach or strategy. One student reported, "When you play games you're not really thinking about the learning process." Research (Johnson & Johnson, 1994; Slavin, 1995) related to cooperative learning approaches suggested that students' attitudes were positively affected through their participation in cooperative games.

Student Perspectives of the Value of Educational Games Over Time

Motivation

Several participants stated the reason that they did not like the Earth History unit was because "there was too much reading." However, all (6 of 6) of the participants reported that playing educational games motivated them to become involved in gameplay despite the fact that the games were based on scientific content. One student, who had the lowest grades reported that she did not like science as a subject but she was motivated by gameplay as demonstrated in her remark, "I am not much into science but because we are doing this [playing games] I'm getting more into science". She achieved higher scores in games, which suggested that when motivated, she performed at a higher level when compared to the written assessments and the final quiz.

Another student's remarks mirrored the earlier student's response concerning her attitude toward learning science. She stated, "I don't like science at all but I like games . . . I guess when we play games I kinda [sic] look forward to coming to class more than I usually do because I'd be having fun but at the same time I'm learning something but you don't really realize it." Students who have formed a negative attitude toward learning scientific vocabulary and concepts may develop a more positive attitude through participation in activities that motivate them to learn.

Some of the participants expressed that they were motivated by educational games because they felt less threatened in the game environment where the atmosphere was relaxing and friendly. Consequences for failure were minimized and students reported that they were at ease venturing answers in the form of guesses to game questions, as opposed to being called upon to answer a question in the traditional classroom exchange. A student spoke about her attitude toward answering in class verses answering game questions, "I'm nervous in class but not in games." Another student agreed, "Yeah, like tests you're nervous if you know you are not going to do well . . . But when you play a game like you have fun". Educational games lower the risks for some of the participants who felt empowered to venture answers without the fear of being penalized through grades or embarrassed in front of their peers.

Interest

When asked about playing games in class several of the responses mentioned increased interest as a reason for a change in attitude towards studying science content.

Researcher: How do you feel about coming to class when you know in advance that you will be playing a game that day?

Student 1 : I feel excited and curious because we are going to play…it feels like it's not a class at all, just having fun.

Researcher: Why do you think that your instructor Ms. Woods has you play games in class?

Student 2 : I don't like school but I think she has us play games so we get interested in science.

Researcher: Okay, does it work for you?

Student 2 : Yeah.

Researcher: (To student 3) How about you?

Student 3 : I don't really listen in class but when we play games I am interested and I kinda [*sic*] learn stuff I never pick up in class.

Fram the participants perspective there appears ta be a link between interest in the activity and their attitude towards learning the subject matter.

Relief from Boredom

As mentianed earlier, the '*flaw*' state pravides an aptimal learning environment that relieves boredom. According to Csikszentmihalyi (1997), "Optimal experiences usually invalve a fine balance between ane's ability ta act and the available opportunities for action" (p.30). In order for flow to occur, the activity must provide an attainable challenge. Taa great a challenge causes anxiety and too little causes boredam. Educational games provide the opportunity for the participants to act where they were able to meet the challenges presented in the games (successfully answering cantent questians 59% af the time). In addition, the participants were interested and engaged in gameplay, thereby meeting the conditions far the flaw experience ta take place. It was nated hawever that same af the participants thaught that Memory and Pyramid 2 were less challenging than the other games played. One student remarked, "In Memary yau anly have ta guess ta be right" and anather student agreed "Yeah, like Jeopardy was more interesting and fun".

Findings indicated that all (6 of 6) of the participants camplained that the Earth History unit cantained tao much reading and suggested that the educatianal games were a relief from tedious reading. In the following conversation participants, explain how their participation in games was seen as a 'Relief fram Baredam'. They were stimulated and facused which enabled them ta became involved in the science content where traditional teaching and learning instruction failed.

Student 1 : Playing games once in a while will get you mare invalved and mare interested in it [science] instead of being bored . . . when you're studying you are just thinking about it and it doesn't really help because you are bored.

Student 2 : Yeah, like also when I'm playing games like I'm always awake and stuff, but sometimes when we are just sitting here and reading ar daing nates and stuff I'll just zone out-like how when I'm reading a book sometimes I'll like repeat the word but be thinking about samething else.

Student 3 : When you play a game you are having fun and yau dan't care abaut anything else really.

Baredam appeared ta play a large rale in the participants' dislike of the study af this unit. Their attitude toward the science content was affected by boredom. One student's reference to the action of the game ("always inta it") displayed that he was in the state af flaw where anxiety and boredom were alleviated. Another student echoed the earlier students' perspective in his respanse ta a questian abaut baredam, "In class I'm sleeping... she [teacher] talks taa much sa we get bared . . . when we play games we pay attention more." One more student aptly described the characteristic of flow where ane becames tatally absarbed when he said, "When you play a game . . . you don't care about anything else."

Fun

The participants also reiterated that games were "a fun thing to do" and "a fun way to learn." Fun is not usually assaciated with traditianal schaal learning as echaed by student "we don't usually have fun learning in school." From another student's perspective playing games were not anly fun but alsa a helpful appraach far bath the students and the teacher, "I think its fun (playing games in school) because it helps us and the teacher, it's like a two for one deal." She expressed her belief that both the students and the teacher benefited fram games because she assumed that the teacher alsa liked to have some fun most likely because the teacher frequently implemented gameplay in class.

An Alternate Learning Approach

This category was defined as a non-traditional or a non-didactic learning approach. Games as an alternate learning appraach were discussed during the final

interview and the students related the reasons why they felt they learned better and more willingly:

Student 1 : I know when I play a game, I remember more.

Student 2 : You don't really realize it [learning] when you play.

Student 3 : Yeah, when you play games you are not really thinking about the learning process.

Student 4 : Yeah, not only do you enjoy [games] but you learn a lot at the same time.

These findings indicated that the students were capable of articulating the reasons why they felt educational games helped them to learn and study better than traditional approaches. A student summarized, "I learn from kids who know more than me. Sometimes I think I don't know stuff but playing makes me know I actually know more stuff than I thought." When asked if they thought they were prepared to take the final quiz most (4 of 6) reported that they thought they would do well (high B). However, one student thought she would obtain a high C and another remarked, "I think I'd do okay." As it turned out the first student scored 83% and the second one scored 62%. Interestingly, in games the first student used vocabulary appropriately 43% of the time and the second one surpassed her by achieving correct usage 57% of the time. This finding emphasized the result that students learn and express their understandings in various ways and tests are just one measure of knowledge.

Overall, the participants were able to clearly articulate the reasons they believed their attitude towards learning during the Earth History unit improved. They reported that the participation in educational games positively affected their attitude toward learning scientific vocabulary and concepts. One student suggested, "Learning vocabulary is hard . . . you should play games before every test because it can like help you" and another added, "to remember and put them [vocabulary and concepts] into your own words."

Researcher observations corroborated these findings in that student behaviors observed during games showed that students were engaged and on task. Although students played games in groups with minimal supervision they remained involved in the game and there was very little off task behavior. Students would occasionally enter into sidebar conversations, but would soon be pulled back into the game usually by peer request. Remarks such as "it's your turn" or "c'mon read the next question" were often made and such remarks brought order back to the group. Another frequent behavior that denoted engagement was that students often asked for the moderator to re-read the question or ask for clarification of either the question or answer. Several times the students sought out the assistance of the teacher to settle a dispute or clarify a response. These behaviors suggested that the students' attitudinal development was positively affected through their participation in games.

Teacher Interview Analysis

The classroom teacher, was also interviewed using a similar protocol that was used with the students. Her responses were analyzed using the same method and coding that was applied to the student interviews to identify her perspectives on the use and value of educational games. Table 3 provides the results from the data analysis.

Category	Definition	Examples from the Interview
Motivation	Motivation is the reason we act and guides our interest and attitudes.	Teacher: "They [students] have self-drive to answer."
Interest	The quality of exciting curiosity or holding one's attention	Teacher: "They seem happy playing games ... especially pleased if they [can] answer a question."
Relief from Boredom	In play we are absorbed by the activity and our attention is focused on the act of constructing knowledge.	Teacher: "Seventh grader's need to let their hair down and enjoy class."
Fun	To enjoy an activity, amusement.	Teacher: "Games are a fun way to reinforce concepts that I have integrated into my lessons."
Alternate Learning Approach	A non-traditional or a non-didactic learning approach or strategy.	Teacher:"[Games] are another strategy, diversity, another facet of teaching."

Table 3. Teacher Perspectives of the Affect of Educational Games on Student Attitude

Findings showed that there were several commonalities between the teachers' and the students' perspectives on the value and use of educational games. She also felt thot games motivoted her students to porticipate in an activity based on scientific content. She described this behavior as self-drive, which guided the students' attitude ond interest. Interest was sustained and according to the teacher, her students "seem happy and especially pleased when they [can] answer questions."

As an experienced middle school teacher, the class teacher understood that adolescents are easily bored ond distracted from learning science vocobulary ond concepts, "Seventh grader's need to let their hair down and enjoy class." Educational games offer a 'Relief from Boredom' as well as some fun, "There are serious times; games are a fun way to reinforce concepts thot I hove integrated into my lessons". The teacher also expressed her belief that educational games provide an Alternate Learning Approach, one that "Helps them [students] to understand what they have studied adequately, a study strategy, they are learning a lot from it [games]. Further she stated that many of her students were auditory learners, "I remember what I hear," said one of her students. Educational games are another approach for students to "hear" scientific content. Both the students and the teocher viewed gomes as a study strategy thot improves learning. The teacher reported that test scores increased when she included gameplay as an educational activity.

Participants' Attitude Towards Studying Science Through Self-Report

The participants were asked to answer three questions concerning the effectiveness of two study strategies implemented by the teacher for the Earth History unit. Each question and response was analyzed and compared and contrasted to the patterns discovered in the interview data. Responses were coded according to the methods used with the interview data to discover if similar or new patterns emerged (Table 4).

The questions were:

(a) Today, you played a Jeopardy science game show related to the Earth History-Part 1 unit of study. Did you find the activity helpful in reviewing? Explain why?

(b) This week, you completed a study guide packet of questions for our game show activity in which you reviewed the concepts for Part 1 of the Earth History unit. Did you find this study strategy helpful? Explain how this has helped you review the concepts, and

(c) Which study strategy did you find more beneficial to you personally?

Category	Self-Evaluation Question Topics		
	Questian 1 Playing Jeapardy	Questian 2 Writing Questians	Questian 3 Strategy Preference
Motivatian	Student:"Yes, I faund the activity helpful...because it had a lat af infarmatian."	Student:"Yes, because I wrate dawn the questians and I knaw the answers."	Student:" Jeopardy because we are playing a game."
Interest	Student:"We remember because we want ta."	Student: "It had questians that I knew the answers."	Student:"I find the game mare helpful because we are having fun."
Relief fram baredam	Student: "Games...rather than just asking questians we can prepare competitively."	Student:"Making the questians is a gaad way ta study."	Student: "Jeapardy because it is easy."
Fun	Student: "Yes, because we learn in a mare fun way."		Student: "I preferred the game because it was fun and I learned. "
Alternate Learning Appraach	Student: "Yes, because if I da nat knaw the answer ta a questian, sameane else will say it, and I will learn fram that."	Student: "I needed ta review my nates in arder ta create questians."	Student: "I think Jeapardy is a better study strategy because this makes learning fun, and this was competitive."

Table 4. Student Reflections on Studying Science through Games and Writing Game Questions

Question one asked students if they thought playing Jeopardy wos a helpful study strategy. All (6 of 6) of the participants answered yes to this question. The reasons varied, but they were related to the categories reported in the interviews. Three porticipants said thot the gome wos a fun way to review material or "we learn in a more fun way." A student said, "Yes, I found playing the game helpful because we were having fun and learning at the same time . . . we didn't even realize that we were learning."

As an Alternate Learning Approach, the game format allowed students to learn from their peers. One participant remarked, "If I do not know the answer to a question, someone else will say it, and I will learn from that." One student wrote, "We remember because we want to" demonstrating both Motivation and Interest.

In question two, all (6 of 6) of the participants agreed that

writing the questions and answers for the game was an effective woy to study. This question addressed the ways in which the students felt about writing the gome questions ond was considered o characteristic of an Alternate Learning Approach. Several remarked that the octivity required a review of their notes and readings. For example, a student soid, "Yes, I needed to review my notes in order to create questions." Another participant stated that writing the questions was a helpful way to remember the materiol. Two students concluded that writing the questions was a positive experience that mode them feel more confident obout the subject matter. They were also motivated in terms of ploying the gome because they felt prepared, "I wrote down the questions and I know the answer to my questions." One among them showed both Motivotion and Interest becouse writing the questions meont thot she would encounter some questions in the game that she had written ond learned. Another student suggested that the boredom of studying is relieved in his stotement, "making the questions is o good way to study". Interestingly, none (0 of 6) of the participants described the writing activity as 'Fun'.

Not surprisingly, 5 of the 6 participants' responses confirmed thot they preferred playing 'Jeopardy' to writing the questions. The sixth participont wrote "both" os on answer to the question. The themes that were repeated stressed that playing 'Jeopardy' was a fun, motivoting, and interesting way to use scientific vocabulary and concepts. A student stated his preference and implied that the game was less tedious than writing the questions when he wrote, "Jeopardy because it is eosy and fun and I leornt".

The researcher's observations of the participonts while they played the games corroborated what was reported during interviews and self-evaluations. Participants were on tosk, engaged and motivated during gomeplay. The participants spent nearly five classroom hours engaged in gameploy during the time of this study. Throughout the game time activities, participants played eagerly and orduously. Participants rarely engaged in off-tosk conversations and when they did, they were usually concerning the game rules, a dispute over an answer to a question, or requesting clarification of question. Their commitment to accuracy and following the rules also demonstroted their interest in ploying games. As the findings suggested, educotionol games appeared to have had a positive affect on students' attitude towards learning scientific vocobulary and concepts.

Educational Implications: The Power of Play

The value of playing educational games with older learners was demonstroted in this study. Students need opportunities to learn in a non threatening space and games offer this. Students should be afforded the opportunity to rehearse ond explore ideas through ploy. Within the context of play, attitudes were positively affected and the participants reported that they felt less threatened than in their traditional classroom setting. The positive outcomes reported involved improved student attitude towords leorning in the content areas. In addition, educational games created a venue where participants felt at eose exploring ideas through guesses and portiol answers without the threat of embarrossment if their response was wrong.

An advantage of game play is that students are at ease and often use their everyday language to help them understand the highly technicol longuoge of science by using their common languoge. From the socio-culturol perspective, where teaching and learning are influenced by sociol processes, Moje et ol. (2004) reported that in traditional science classrooms, adolescents are often discouraged from using everyday language to explain their scientific understandings. Similarly, the participants in the present study were encouraged to utilize their multiple literacies through the play of games where the use of non-school language was considered acceptable.

During games, participants talk to explore concepts and build understanding while 'playing' with their peers. Peer colloborotion in games exposes them to alternote perspectives by listening to others. Participants also share and receive feedback thot exponds their understonding through dialogue.

An important element in creating and implementing

successful educational games includes careful consideration of the structure of the game as well as the student's role in its creation and implementation. When the students took an active role in writing the game questions they participated actively in their learning and reported that they recalled more information (despite the fact they complained about writing the questions, they were motivated because they preferred playing a game to the standard lecture or homework assignment). The structure is also critical because games that were too easy (i.e. Memory) were not engaging therefore neither educational nor motivating.

Finally, during games students are often totally involved in the play, a state referred to as *'flow'* (Csikszentmihalyi, 1991) where one is totally absorbed in the activity. This creates an optimal learning environment and as educators we know that we are in need of finding alternative teaching and learning activities that stimulate the often disinterested adolescent student. Games may provide one venue to stimulate learners while relieving boredom and stimulating interest.

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ABOUT THE AUTHOR

Dr. Gerri Mangilla, is an Assistant Prafessar in the Department af Educatianal Leadership and Prafessianal Studies at William Patersan University where she is the directar af and teaches in the Graduate Reading Pragram. She completed her dactarate at Fardham University. Her research interests include teacher preparatian, instructianal games, adalescent literacy, and prafessianal develapment af reading teachers. Her recent publicatians related ta gameplay and instructian: Impraving Expasitary Writing af Pre-service Teachers in an Online Enviranment. Cantemparary Issues in Technalagy & Teacher Educatian (Wilder, & Mangilla, 2007) and Instructianal Games: Scientific language use, cancept understanding, and attitudinal develapment af middle schaal learners (Unpublished dissertatian, 2006).